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MANDEL'SHTAM PRIZE WINNER YE. L. FAYNBERG

In 1950, the Academy of Sciences USSR awarded the L. I. Mandel'shtam Prize to Yevgeniy L'vovich Faynberg, Doctor of Physicomathematical Sciences. This prize is awarded once every 3 years for the best work in radio.

In addition to many notable works in the field of theoretical physics, Faynberg has solved a hitherto insoluble problem in radio-wave propagation. We will not attempt to give his theory, but will only state some results of his work which are of the greatest interest to amateurs.

As we know, the properties of the earth's surface play an important role in the propagation of long and medium waves, as well as in the propagation of a ground wave in the case of short waves. Wave propagation along the earth's surface causes the formation of electric currents in the earth. Part of the wave energy is lost in sustaining these currents. Consequently, radio waves are attenuated as they are propagated outward and the degree of attenuation depends on the electric properties of the soil. Hitherto this attenuation could be calculated only for the uniform path of a ground wave, that is, only when the soil properties were assumed to be identical along the entire path of the wave. For a nonuniform path, it was usually assumed that each section having identical soil properties could be examined separately and that the total attenuation for the entire path could be computed as the product of the attenuations in the individual uniform sections (or as the sum of individual attenuations if these were expressed in decibels).

This was a natural hypothesis but one of the results of Faynberg's theory showed that it was erroneous. Let us imagine that a ground wave is first propagated over land where attenuation is high and next over the sea where attenuation is slight. Now, it turns out that the field intensity over the sea does not decrease but may even increase in some parts of the path. In other words, for a certain part of the path, reception is actually improved instead of being weakened as we move away from the transmitter.

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At first glance, this statement seems paradoxical. Of course, it is true that if, on its propagation path, part of a radio wave's energy is absorbed by the ground, it is lost forever and cannot be reconverted into wave energy. But the fact is that radio waves are not propagated directly over the earth's surface alone. They are also propagated high above the earth in free space and from these upper regions the energy of electromagnetic waves can flow down to the lower layer near the earth and compensate to some degree for energy losses in the ground. The energy flowing from the upper layers may even overcompensate these losses when they are very small, and the field at the earth will be intensified as the waves are propagated outward.

This surprising result of Faynberg's work is of practical as well as theoretical value. For example, if transmission takes place on land and reception on the seashore, reception may be considerably better at sea at some distance from shore than on the shore itself. Again, if a land station has to be received on the shore of a bay, the most favorable site for the receiving station might be on the shore farther from the transmitting station instead of on the shore nearer it.

Similar effects have been observed in practice, but since no earlier theory explained them, there was a tendency to ascribe them to some technical error.

The chief results of Faynberg's theory may be described in the following manner: In the propagation of a ground wave the earth's electric properties act differently at different parts of the path. The effect of these properties on radio communication is greatest in the areas where the transmitter and receiver are located. Academician L. I. Mandel'shtam called these areas the take-off and landing fields of radio waves. At a distance from the transmitter and receiver, the effect of the earth's properties are far less important. Hence if, on one hand, radio communication is carried on from sea to sea across land and, on the other hand, from land to land across the sea over identical distances, radio reception will be much better in the former case than in the latter.

These examples, few as they are, suffice to illustrate the significance and novelty of the results obtained from Faynberg's theory.

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